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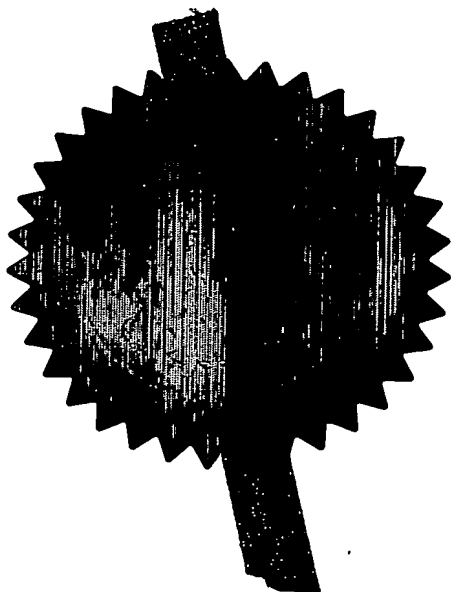
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OXONICA LIMITED
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- Patents ADP number (*if you know it*)
- If the applicant is a corporate body, give the country/state of its incorporation UNITED KINGDOM
4. Title of the invention 81 47845001
SUNSCREENS
5. Name of your agent (*if you have one*) J.A. KEMP & CO.
"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)
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Abstract 1

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J.A. Kemp & Co.
J.A. KEMP & CO.

Date 1 April 2003

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SUNSCREENS

The present invention relates to UV screening compositions suitable for cosmetic use.

5 The effects associated with exposure to sunlight are well known. Thus exposure of the skin to UVA and UVB light may result in, for example, sunburn, premature ageing and skin cancer.

Commercial sunscreens generally contain components which are able to reflect and/or absorb UV light. These components include, for example, inorganic
10 oxides such as zinc oxide and titanium dioxide as well as organic sunscreen agents.

The general public are generally more concerned by the obvious effects of sunlight, namely sunburn which causes reddening of the skin than they are with other effects of sunlight which are less self evident. As a consequence of this commercial sunscreen compositions are rated by a Sun Protection Factor (SPF). This is a
15 measure of the time taken for skin to redden under a layer of the composition as compared with untreated skin. Thus an SPF of 20 indicates that skin will take 20 times longer to redden under a layer of the composition applied at 2mg per cm² compared with untreated skin. This reddening effect is caused principally by UVB light. There is no recognised corresponding factor for the effects of UVA light even
20 though the latter may be more damaging in the long term.

Most organic sunscreen agents absorb light over only a part of the UVA-UVB spectrum with the result that if one is to obtain a screening effect covering the whole UVA-UVB spectrum it is generally necessary to use a combination of different
25 organic sunscreen agents. Some organic sunscreen agents and other components of sunscreen compositions are stable to UV light but others are photosensitive and/or may after being excited by UV light degrade another ingredient of the composition.

Titanium dioxide and zinc oxide are generally formulated as "micronised" or "ultrafine" (20-50 nm) particles (so-called microreflectors) because particles whose size is less than 10% of the wavelength of the incident light scatter light according to
30 Rayleigh's Law, whereby the intensity of scattered light is inversely proportional to the fourth power of the wavelength. Consequently, they scatter UVB light (with a wavelength of from 280 or 290 to 315/ 320 nm) and UVA light (with a wavelength of from 315/320 to 400 nm) more than the longer, visible wavelengths, preventing

sunburn whilst remaining invisible on the skin.

However, titanium dioxide and zinc oxide also absorb UV light efficiently, leading via the initial formation of electron hole pairs to the formation of superoxide and hydroxyl radicals and which may in turn initiate damage to other components of the composition. The crystalline forms of TiO_2 , anatase and rutile, are

semiconductors with band gap energies of about 3.23 and 3.06 eV respectively, corresponding to light of about 385 nm and 400 nm (1 eV corresponds to 8066 cm^{-1}). Indeed there is evidence to suggest that TiO_2 can enhance the degradation of organic sunscreen agents, including UVA organic sunscreens, for example oxybenzone.

Attempts have been made to reduce the adverse effects of TiO_2 and ZnO by coating but coatings are not invariably effective.

The reason why a sunscreen agent does not have a substantially perpetual effect (i.e. an SPF factor which is substantially infinite) is because the organic sunscreen agents are degraded by light and/or are adversely affected by other components of the sunscreen composition once the latter are subjected to UV light.

It has now surprisingly been found, according to the present invention, that the degradation of organic sunscreen agents, and other components which are susceptible to degradation, can be retarded if the compositions also have present zinc oxide or titanium dioxide which has been doped with a second element. In other words by using these doped materials rather than ordinary titanium dioxide or zinc oxide it is, for example, possible either to provide a composition which gives better protection against UV light for the same quantity of organic sunscreen agent or a composition having the same screening effect against UV light but containing a smaller quantity of organic sunscreen agent.

Accordingly the present invention provides a cosmetic UV suncreening composition which comprises an amount of one or more organic components which are photosensitive and/or which are degraded by another ingredient of the composition, optionally together with an amount of TiO_2 and/or ZnO which has not been doped with a second element and an amount of TiO_2 and/or ZnO which has been doped with a second element, this composition having a rate of loss of UV absorption at least 5% less than that of a composition having the same formulation except that it does not contain the said TiO_2 and/or ZnO which has been doped with a

second element. Thus if the rate of loss of UV absorption over at least a proportion of the UVA and/or UVB spectrum is X then the amount of the organic component(s) which are photosensitive and/or which are degraded by another ingredient of the composition, optionally together with the amount of undoped TiO_2 and/or ZnO , possesses a said rate of loss of Y where Y is greater than X by at least 5%, and the amount of doped TiO_2 and/or ZnO reduces the said rate of loss from Y to X. The present invention also provides the use of a doped TiO_2/ZnO to reduce the concentration of one or more organic UV sunscreen or other photosensitive ingredient or ingredient which is degraded by another ingredient of the composition in a cosmetic UV screening composition as well as to reduce the rate of loss in UV absorption of a sunscreen composition containing one or more organic UV sunscreen agents. The present invention further provides a method of increasing the effectiveness of an organic suncreening composition which comprises one or more components which are photosensitive and/or which are degraded by another ingredient of the composition which comprises incorporating into the composition a doped TiO_2/ZnO .

By "cosmetic UV suncreening composition" is meant any cosmetic composition having UV suncreening activity i.e. it includes compositions whose principal function may not be suncreening. It will be appreciated that the doped TiO_2/ZnO may be the only ingredient of the composition having UV suncreening activity i.e. the composition need not necessarily contain an organic UV sunscreen agent.

The organic component which is photosensitive or degraded by another ingredient of the composition is generally a UV sunscreen agent. Although all organic sunscreen agents which suffer a loss in UV absorption can be used, the present invention is particularly useful for agents which absorb in the UVA region. However, other organic components will generally be susceptible to free radical attack and in turn this generally will cause degradation of the UV sunscreen agent.

As indicated above the UV absorption of an organic sunscreen agent decreases with time. In contrast the UV absorption of TiO_2 or ZnO does not decrease with time, or does so to a lesser extent. Since TiO_2 and ZnO absorb in both the UVA

and UVB region whereas an organic sunscreen agent is generally more wavelength specific it can be seen that the rate of change of the UVA/UVB absorption ratio may increase over time. When a doped TiO_2/ZnO is used rather than the same quantity of undoped TiO_2/ZnO the rate of change is reduced. This is because the doped material will enhance the performance of the organic sunscreen agent over time. Thus with a UVA sunscreen the loss of UVA absorption over time is reduced (i.e. the UVA response is more stable when the doped material is present) so that the ratio of change of the ratio is reduced. Thus if the initial ratio of absorption is $\frac{X}{Y}$

becomes $\frac{X - x}{Y}$ where x is smaller when a doped material is used with the result

that the rate of change is less. With a UVB sunscreen, the rate of change is also reduced as a consequence of a more stable UVB response.

The rate of loss of absorption can be determined by illuminating a sample of the composition with and without the doped TiO_2 and/or ZnO of defined thickness with UV light of the appropriate wavelength and determining the absorption of UV by the composition over a given period, typically 60 minutes, obtaining a plot over that period for the wavelengths in question and determining the area under the curve from which the rate of loss can be calculated. Clearly the smaller the area under the curve the smaller the loss. For UVA absorption wavelengths from 320 to 400, especially from 340 to 390 nm, are considered.

While any reduction in the loss of UV absorption is an advantage, it is generally desirable that the presence of the doped oxide should reduce the rate of UV absorption by an amount of at least a 5%, preferably at least 10%, more preferably at least 15%, especially at least 20% and most preferably at least 40%.

A further feature of the present invention resides in the fact that the doped TiO_2/ZnO is generally coloured. As a result the use of such doped materials causes the composition to absorb more of the visible light which impinges upon it i.e. less visible light is transmitted and reaches the skin.

The dopant for the oxide particles is preferably manganese, which is

especially preferred, e.g. Mn^{2+} but especially Mn^{3+} , vanadium, for example V^{3+} or V^{5+} , chromium and iron but other metals which can be used include nickel, copper, tin, aluminium, lead, silver, zirconium, zinc, cobalt, gallium, niobium, for example Nb^{5+} , antimony, for example Sb^{3+} , tantalum, for example Ta^{5+} , strontium, calcium, magnesium, barium, molybdenum, for example Mo^{3+} , Mo^{5+} or Mo^{6+} as well as silicon. Manganese is preferably present as Mn^{3+} , cobalt as Co^{2+} , tin as Sn^{4+} as well as Mn^{2+} . These metals can be incorporated singly or in combination of 2 or 3 or more. Further details of these doped oxides can be found in WO99/60994 as well as WO01/40114.

The average primary particle size of the particles is generally from about 1 to 200 nm, for example about 1 to 150 nm, preferably from about 1 to 100 nm, more preferably from about 1 to 50 nm and most preferably from about 20 to 50 nm. The particle size is preferably chosen to avoid colouration of the final product.

Where particles are substantially spherical then particle size will be taken to represent the diameter. However, the invention also encompasses particles which are non-spherical and in such cases the particle size refers to the largest dimension.

The optimum amount of the second component in the host lattice may be determined by routine experimentation but it is preferably low enough so that the particles are not coloured. Amounts as low as 0.1 mole % or less, for example 0.05 mole %, or as high as 1 mole % or above, for example 5 mole % or 10 mole %, can generally be used. Typical concentrations are from 0.5 to 2 mole % by weight.

These particles can be obtained by any one of the standard processes for preparing doped oxides and salts. Thus they can be obtained by a baking technique by combining particles of a host lattice (TiO_2/ZnO) with a second component in the form of a salt such as a chloride or an oxygen-containing anion such as a perchlorate or a nitrate, in solution or suspension, typically in solution in water, and then baking it, typically at a temperature of at least 300°C . Other routes which may be used to prepare the doped materials include a precipitation process of the type described in J. Mat. Sci. (1997) 36, 6001-6008 where solutions of the dopant salt and of an alkoxide of the host metal (Ti/Zn) are mixed, and the mixed solution is then heated to convert the alkoxide to the oxide. Heating is continued until a precipitate of the doped

material is obtained. Further details of preparation can be found in the aforesaid patent specifications.

The rutile form of titania is known to be more photostable than the anatase form and is therefore preferred.

5 The oxide particles of the present invention may have an inorganic or organic coating. For example, the particles may be coated with oxides of elements such as aluminium, zirconium or silicon. The particles of metal oxide may also be coated with one or more organic materials such as polyols, amines, alkanolamines, polymeric organic silicon compounds, for example, $\text{RSi}[\{\text{OSi}(\text{Me})_2\}_x\text{OR}^1]_3$ where R is $\text{C}_1\text{-C}_{10}$ alkyl, R^1 is methyl or ethyl and x is an integer of from 4 to 12, hydrophilic
10 polymers such as polyacrylamide, polyacrylic acid, carboxymethyl cellulose and xanthan gum or surfactants such as, for example, TOPO.

15 The compositions of the present invention may be, for example, lipsticks, skin anti-ageing compositions in the form of, for example, creams, exfoliating preparations including scrubs, creams and lotions, skin lightening compositions in the form of, for example, face powders and creams, preparations for the hands including creams and lotions, moisturising preparations, compositions for protecting the hair such as conditioners, shampoos and hair lacquers as well as hair masks and gels, skin cleansing compositions including wipes, lotions and gels, eye shadow and
20 blushers, skin toners and serums as well as washing products such as shower gels, bath products including bubble baths, bath oils, but, preferably, sunscreens. In this connection we should point out that the expression "cosmetic UV suncreening composition", as used herein, includes any composition applied to the skin which may leave a residue on the skin such as some washing products. Compositions of the
25 present invention may be employed as any conventional formulation providing protection from UV light.

30 Organic sunscreen agents which can be used in the compositions of the present invention include any conventional sunscreen agent which gives protection against UV light while if there is no other photosensitive component the sunscreen agent is photosensitive and/or is degraded by another ingredient of the composition. Suitable sunscreen agents are listed in the IARC Handbook of Cancer Prevention,

vol. 5, Sunscreens, published by the International Agency for research on cancer, Lyon, 2001 and include:

- (a) Para-aminobenzoic acids (PABA), (UVB absorbers) esters and derivatives thereof, for example amyl dimethyl-; ethyldihydroxypropyl-; ethylhexyl dimethyl-; ethyl-; glyceryl-; and 4-bis-(polyethoxy)- PABA.
- (b) Cinnamates (UVB) especially esters including methyl cinnamate esters and methoxycinnamate esters such as octylmethoxy cinnamate, ethyl methoxycinnamate, especially 2-ethylhexyl para-methoxycinnamate, isoamyl p-methoxy cinnamate, or a mixture thereof with diisopropyl cinnamate, 2-ethoxyethyl -4-methoxycinnamate, DEA-methoxycinnamate (diethanolamine salt of para-methoxy hydroxycinnamate) or α,β -di-(para-methoxycinnamoyl)- α' -(2-ethylhexanoyl)-glycerin, as well as diisopropyl methylcinnamate;
- (c) benzophenones (UVA) such as 2,4-dihydroxy-; 2-hydroxy-4-methoxy-; 2,2'-dihydroxy-4,4'-dimethoxy-; 2,2'-dihydroxy-4-methoxy-; 2,2',4,4'-tetrahydroxy-; and 2-hydroxy-4-methoxy-4'-methyl-benzophenones, benzenesulphonic acid and its sodium salt; sodium 2,2'-dihydroxy-4,4'-dimethoxy-5-sulphobenzophenone and oxybenzone;
- (d) dibenzoylmethanes (UVA) such as butyl methoxydibenzoyl methane, especially 4-tert-butyl-4'methoxydibenzoylmethane;
- (e) 2-phenylbenzimidazole-5 sulfonic acid UVB and phenyldibenzimidazole sulfonic acid and their salts;
- (f) alkyl- β,β -diphenylacrylates (UVB) for example alkyl α -cyano- β,β -diphenylacrylates such as octocrylene;
- (g) triazines (UVB) such as 2,4,6-trianilino-(p-carbo-2-ethyl-hexyl-1-oxy)-1,3,5 triazine as well as octyl triazone e.g. ethylhexyltriazone and diethylhexyl butamido triazone.
- (h) camphor derivatives (generally UVB) such as 4-methylbenzylidene and 3-benzylidene- camphor and terephthalylidene dicamphor

sulphonic acid (UVA), benzylidene camphor sulphonic acid, camphor benzalkonium methosulphate and polyacrylamidomethyl benzylidene camphor;

- (i) organic pigment sunscreens such as methylene bis-benzotriazole tetramethyl-butylphenol;
- (j) silicone based sunscreens such as dimethicodiethyl benzal malonate.
- (k) salicylates (UVB) such as dipropylene glycol-, ethylene glycol-, ethylhexyl-, isopropylbenzyl-, methyl-, phenyl-, 3,3,5-trimethyl- and TEA-salicylate (compound of 2-hydroxybenzoic acid and 2,2'2"-nitrilotris (ethanol));
- (l) anthranilates (UVA) such as menthyl anthranilate as well as bisimidazylate (UVA), dialkyl trioleate (UVB), 5-methyl-2-phenylbenzoxazole (UVB) and urocanic acid (UVB).

Some compounds are effective for both UVA and UVB. These include anisotriazine, methylene bisbenzotriazolyl tetramethylbutyl-phenol and drometrizole trisiloxane (Mexoryl XL).

The organic sunscreen agent(s) are typically present in the compositions at a concentration from 0.1 to 20%, preferably 1 to 10%, and especially 2 to 5%, by weight based on the weight of the composition.

In the compositions the metal oxides are preferably present at a concentration of about 0.5 to 20 % by weight, preferably about 1 to 10 % by weight and more preferably about 3 to 8 % by weight, in particular about 4 to 7%, such as 4 to 6% for example about 5%, by weight.

The compositions may be in the form of, for example, lotions, e.g. thickened lotions, gels, vesicular dispersions, creams, milks, powders, solid sticks, and may be optionally packaged as aerosols and provided in the form of foams or sprays.

The compositions may contain any of the ingredients used in such formulations including fatty substances, organic solvents, silicones, thickeners, demulcents, other UVA, UVB or broad-band sunscreen agents, antifoaming agents,

moisturizing agents, perfumes, preservatives, surface-active agents, fillers, sequesterants, anionic, cationic, nonionic or amphoteric polymers or mixtures thereof, propellants, alkalizing or acidifying agents, colorants and metal oxide pigments with a particle size of from 100 nm to 20000 nm such as iron oxides along with conventional (undoped) TiO_2 and ZnO .

It is known that other ingredients of cosmetic compositions, for example some surface-active agents may have the effect of degrading certain sunscreen agents in the presence of UV light. Also TiO_2 and ZnO are known to degrade certain organic sunscreens such as oxybenzone as well as antioxidants such as vitamins e.g. vitamins A, B, C and E. It will be appreciated that is particularly useful to use the doped TiO_2 and/or ZnO with such sunscreens. This is because TiO_2 and ZnO do generally have a positive UV absorptive effect. Thus by using the doped TiO_2 and/or ZnO it may be possible to use less antioxidant or make the formulation longer lasting.

The organic solvents are typically from lower alcohols and polyols such as ethanol, isopropanol, propylene glycol, glycerin and sorbitol.

The fatty substances may consist of an oil or wax or mixture thereof, fatty acids, fatty acid esters, fatty alcohols, vaseline, paraffin, lanolin, hydrogenated lanolin or acetylated lanolin.

The oils are typically from animal, vegetable, mineral or synthetic oils and especially hydrogenated palm oil, hydrogenated castor oil, vaseline oil, paraffin oil, Purcellin oil, silicone oil and isoparaffin.

The waxes are typically animal, fossil, vegetable, mineral or synthetic waxes. Such waxes include beeswax, Carnauba, Candelilla, sugar cane or Japan waxes, ozokerites, Montan wax, microcrystalline waxes, paraffins or silicone waxes and resins.

The fatty acid esters are, for example, isopropyl myristate, isopropyl adipate, isopropyl palmitate, octyl palmitate, C_{12} - C_{15} fatty alcohol benzoates ("FINSOLV TN" from FINETEX), oxypropylenated myristic alcohol containing 3 moles of propylene oxide ("WITCONOL APM" from WITCO), capric and caprylic acid triglycerides

("MIGLYOL 812" from HULS).

5 The compositions may also contain thickeners such as cross-linked or non cross-linked acrylic acid polymers, and particularly polyacrylic acids which are cross-linked using a polyfunctional agent, such as the products sold under the name "CARBOPOL" by the company GOODRICH, cellulose, derivatives such as methylcellulose, hydroxymethylcellulose, hydroxypropyl methylcellulose, sodium salts of carboxymethyl cellulose, or mixtures of cetylstearyl alcohol and oxyethylenated cetylstearyl alcohol containing 33 moles of ethylene oxide.

10 When the compositions of the present invention are sunscreens they may be in the form of, for example, suspensions or dispersions in solvents or fatty substances or as emulsions such as creams or milks, in the form of ointments, gels, solid sticks or aerosol foams. The emulsions may further contain anionic, nonionic, cationic or amphoteric surface-active agents. They may also be provided in the form of vesicular dispersions of ionic or nonionic amphiphilic lipids prepared according to known processes.

15 The following Examples further illustrate the present invention.

The degradation of sunscreen formulation was assessed as follows:

20 **Methods:**

Preparation of sample

Cut two strips of polythene 10mm x 25mm and 12.5mm thick.

Lay the polythene strips 20mm apart on the centre of a quartz slide.

25 Pipette a drop of about 30ml of sunscreen preparation onto the centre of the slide.

Carefully lay a second quartz slide on top of the sample and squeeze the slides together at the polythene strips thus providing a specimen 12.5µm thick. Take care to avoid air bubbles.

Illumination

Use a Xenon lamp filtered with a Schott WG320 filter to carry out illuminations.

Take a base reading of light output using a spectroradiometer calibrated between 290 and 400 nm.

- 5 Measure the light intensity (290-400nm) through a sample of water to use as a blank (I_q). The intensity over the range 290 - 400 nm is typical of that found in moderate latitudes in mid-summer.

Measure the light intensity (290-400nm) through the sample (I_t) at time 0 - as soon as it is put under the light - and then every 10 minutes for 1 hour.

- 10 At the end of the experiment take another base reading of light output to ensure that the light source has remained steady.

Calculations

Calculate the transmission (K) of the sunscreen film at each individual wavelength:

15
$$K = I_t / I_q$$

This can be used to plot wavelength vs transmission at each timepoint and shows the increase in transmission of an individual sunscreen during illumination.

- 20 The loss of light absorption (D) by the sunscreen at each individual wavelength is calculated as the proportion of the absorption of the sunscreen at T=0 still remaining at T=t:

$$D = K_0 / K_t$$

This can be used plot wavelength vs loss of light absorption. This plot allows comparisons to be made between different sunscreen preparations.

- 25 By measuring the area under this curve at each time point the rate of change of the total UVA absorption can also be calculated.

Formulations

- 30 Commercial sunscreens Factor 5 and Factor 10. These have the following ingredients.

The ingredients in italics are the active sunscreen agents.

These formulations were modified by the incorporation of doped and undoped TiO₂ and ZnO in various concentrations and compared with unmodified formulations.

5

Commercial Factor 5

Aqua

C12-15 alkyl benzoate

10

Glycerin

Butylene glycol dicaprylate/caprate

Ceteareth-20

Glyceryl stearate

Ethylhexyl triazone

15

Butyl methoxydibenzoylmethane

Disodium phenyl dibenzimidazole tetrasulfonate

PVP/hexadecane copolymer

Tocophenylacetate

Cetyl palmitate

20

Cetearyl alcohol

Ceteareth-12

Phenoxyethanol

Methylparaben

Ethylhexylglycerin

25

Trisodium EDTA

Sodium citrate

Citric acid

PEG-4 laurate

PEG-4 dilaurate

30

PEG-4

Iodopropynyl butylcarbamate

Perfume

Commercial Factor 10

5

Aqua

Ethyl hexyl methoxy cinnamate

Glycerin

Cetareth-20

10 Butylene glycol dicaprylate/dicaprate

C12-15 alkyl benzoate

Glycerol stearate

Ethylhexyl triazone

Butyl methoxydibenzoylmethane

15 Phenoxyethanol

Cetyl palmitate

Cetearylalcohol

Cetareth-12

PVP/hexadecane copolymer

20 *Phenyl/benzimidazole sulphonate*

Tocophenyl acetate

Methyl paraben

Ethylhexylglycerin

Trisodium EDTA

25 PEG-4 laurate

PEG-4 dilaurate

PEG-4

Iodopropynyl butylcarbamate

BHT

30 Perfume

The results are shown in the attached Figures in which:

Figure 1 shows the effect of time on absorption in UVA for a sunscreen formulation of factor 10 to which titanium dioxide, undoped or doped with 1% vanadium or manganese has been added.

5- Figure 2 gives the average percentage loss for several formulations.

Figure 3 shows the loss in absorption of a commercial factor 10 formulation in the UVA region at time = 0 up to $t = 60$.

Figure 4 shows the degradation of a factor 5 formulation to which has been added titanium dioxide doped or undoped.

10 Figure 5 shows the proportion of protection remaining for a commercial factor 10 formulation to which zinc oxide, undoped or doped with 1% manganese or iron has been added.

Figure 6 shows the average change in UVA absorption of a commercial factor 10 formulation to which has been added zinc oxide undoped or doped with 15 manganese or iron.

Figure 7 shows the average change in UVA absorption for the same composition to which has been added TiO_2 which has been coated or doped with manganese.

20 It can be seen that the addition of TiO_2 and ZnO reduces the rate of degradation, this being due partly to scattering and partly to additional absorption. TiO_2 or ZnO which is doped with manganese and vanadium, in particular, has a significantly greater effect in that the rate of loss of UV protection is reduced.

25

30

CLAIMS

1. A cosmetic UV sunscreensing composition which comprises an amount of one or more organic components which are photosensitive and/or which are degraded by another ingredient of the composition, optionally together with an amount of TiO_2 and/or ZnO which has not been doped with a second element and an amount of TiO_2 and/or ZnO which has been doped with a second element, this composition having a rate of loss of UV absorption at least 5% less than that of a composition having the same formulation except that it does not contain the said TiO_2 and/or ZnO which has been doped with a second element.
2. A composition according to claim 1 wherein the dopant is manganese, vanadium, chromium or iron.
3. A composition according to claim 2 wherein the dopant is Mn^{3+} .
4. A composition according to any one of the preceding claims wherein the dopant is present in an amount from 0.05% to 10 mole %.
5. A composition according to claim 4 wherein the dopant is present in an amount from 0.5 to 2 mole % by weight.
6. A composition according to any one of the preceding claims which comprises 0.5 to 20 mole % by weight of the doped TiO_2 or ZnO .
7. A composition according to any one of the preceding claims wherein the doped material has a particle size from 1 to 200 nm.
8. A composition according to any one of the preceding claims which comprises doped titanium dioxide.
9. A composition according to any one of the preceding claims wherein the titanium dioxide is in rutile form.
10. A composition according to any one of the preceding claims wherein one or more of the said organic components is a UV sunscreen agent.
11. A composition according to claim 10 wherein the organic sunscreen agent absorbs UV light in the UVA region.
12. A composition according to claim 10 or 11 wherein the organic sunscreen agent is a paraaminobenzoic acid, ester or derivative thereof, a methoxy

cinnamate ester, a benzophenone, a dibenzylomethane, an alkyl- β,β -phenyl acrylate, a triazine, a camphor derivative, an organic pigment, a silicone based sunscreen agent or 2-phenylbenzimidazol-5 sulphonic acid or phenyldibenzimidazol sulphonic acid.

13. A composition according to any one of the preceding claims wherein
5 the said rate of loss of UV absorption is a rate of loss of UVA absorption.

14. A composition according to any one of the preceding claims wherein
the rate of change of the ratio of the loss of UVA absorption to the loss of UVB
absorption is less than that of a composition of the same formulation except that the
TiO₂ and /or ZnO present is not doped.

10 15. A composition according to claim 13 wherein the rate of change of the
ratio is greater because the rate of loss of UVA absorption is reduced.

16. A composition according to any one of the preceding claims wherein
the organic sunscreen agent is one which is degraded by TiO₂ and/or ZnO.

15 17. A composition according to any one of the preceding claims which
comprises 0.1% to 20% by weight of organic sunscreen agent(s).

20 18. A composition according to any one of the preceding claims which
contains one or more of a fatty substance, organic solvent, silicone, thickener,
demulsant, UVB sunscreen agent, antifoaming agent, moisturising agent, perfume
preservative, surface activation filler, sequestrant, anionic, cationic, nonionic or
amphoteric polymer, propellant, alkalising or acidifying agent, colorant or metal
oxide pigment.

19. A composition according to any one of the preceding claims which is
a sunscreen.

25 20. A composition according to any one of the preceding claims which is
in the form of a lotion, gel, dispersion, cream, milk, powder or solid stick.

21. A composition according to claim 1 substantially as hereinbefore
described.

30 22. Use of a doped TiO₂/ZnO as defined in any one of claims 1 to 3 to
reduce the concentration of one or more organic UV sunscreen agents or other
ingredient which is photosensitive and/or is degraded by another ingredient in a

cosmetic UV screening composition.

23. Use of a doped TiO_2/ZnO as defined in any one of claims 1 to 3 to reduce the rate of loss in UV absorption of a sunscreen composition.

24. Use of a doped TiO_2/ZnO as defined in any one of claims 1 to 3 to reduce the rate of change of the ratio of the loss of UVA absorption to the loss of UVB absorption in a cosmetic UV screening composition which comprises one or more organic components which are photosensitive and/or which are degraded by another ingredient of the composition in a relation a composition of the same formulation except that the TiO_2 and /or ZnO present is not doped.

10 25. A method of increasing the effectiveness of an organic UV sunscreensing composition, which comprises one or more components which are photosensitive and/or are degraded by another ingredient of the composition which comprises incorporating into the composition a doped TiO_2/ZnO as defined in any one of claims 1 to 3.

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ABSTRACT

5 A cosmetic UV sunscreensing composition is described which comprises an
amount of one or more organic components which are photosensitive and/or which
are degraded by another ingredient of the composition, optionally together with an
amount of TiO_2 and/or ZnO which has not been doped with a second element and an
amount of TiO_2 and/or ZnO which has been doped with a second element, this
composition having a rate of loss of UV absorption at least 5% less than that of a
composition having the same formulation except that it does not contain the said
10 TiO_2 and/or ZnO which has been doped with a second element.